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GIFFORD PINCHOT, Forester.

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### FOREST PLANTING LEAFLET.

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#### EUCALYPTS.

Several species of eucalypts are suitable for planting in the warmer parts of the United States, but the qualities of the most important are so much the same that only their differences need be referred to. Blue gum is the most extensively planted, and may therefore represent the type.

#### BLUE GUM (*Eucalyptus globulus*).

##### FORM AND SIZE.

The blue gum is an evergreen tree, with smooth, elongated leaves of leathery texture and usually sickle-shaped. Under favorable conditions it grows very rapidly and may attain a height of 150 feet and a diameter of from 3 to 5 feet in thirty years. The form is always slender, though, like most other trees, its crown spreads moderately when given plenty of room. In close stands the stems rapidly clear themselves of branches to a considerable height, but they are rarely straight.

##### RANGE.

The blue gum is not native to the United States, but was introduced from Australia. It has been widely planted in central and southern California, and to some extent in New Mexico and Arizona. Its range is limited by the fact that the young trees can not withstand a lower temperature than 25° F., and it is useless to plant the trees where greater cold occurs. The directions here given are therefore applicable only to limited regions. In California the trees are confined mainly to the citrus fruit belts, although in places the planting range has been successfully extended beyond these limits.

##### SILVICAL QUALITIES.

Blue gum can adapt itself to many kinds of soil, even that containing considerable alkali, but it is entirely dependent upon a plentiful supply of moisture about its roots. Without that, it grows slowly and does not sprout readily. The soil best suited to it is a deep, sandy loam, with ground water within 10 or 15 feet of the sur-

face. In many localities the lack of water is supplied by irrigation, but as a rule irrigated land is too valuable for commercial plantations. Atmospheric moisture is not at all necessary; on the contrary the tree grows fastest with its roots close to water and its crown exposed to the sun and wind.

Blue gum develops a strong taproot and a vigorous secondary root system, both of which are capable of penetrating to considerable depths in search of moisture.

The tree is extremely intolerant of shade. Its seedlings thrive for a time beneath the old trees, but if the cover is at all dense they make only a slow growth. This indicates the need of so managing a grove that each individual has its crown entirely free.

It is practically free from injurious insects and fungi. Damage from wind is to be feared only on very shallow soil.

#### ECONOMIC USES.

The wood is very heavy, hard, strong, and tough, but not durable. It is easy to split when first felled, but not after it has dried. It resembles hickory in many of its qualities, but is extremely difficult to season. The trees are sometimes sawed into lumber and used for wagon work and agricultural implements, though for none of these purposes is the wood as good as that of several native species. It is coming into use for piles in sea water, and it appears to be quite valuable for that purpose, though the trials are not yet conclusive. Its chief value at present is as firewood, for which it is in constant demand in parts of California where other good fuel is scarce. This recommends it for commercial plantations. Another important use of the tree is for windbreaks to protect orange and lemon orchards from the high winds that are prevalent in many parts of the fruit-growing section. No other tree will make so good a shelterbelt in so short a time as blue gum.

#### METHODS OF PROPAGATION.

The blue gum reproduces freely both by seeds and by stump sprouts. Plantations must be established by seedlings, but the vigor of the sprouts recommends that means of renewing a grove when it is cut.

The seeds are produced in large quantities every year. Most of them ripen in the fall, usually just before the rains. The fruit should be gathered before the valves open, and spread on sheets in the sun. In a few days the seeds will be freed and may be easily separated from the hulls and chaff. They should be planted at once in shallow boxes filled with not less than 3 or 4 inches of sandy loam, or in small paper or bamboo pots. The box most commonly

used is 18 by 30 inches and 3 inches deep. It is better to plant the seed in this way than in seed beds, because the boxes or pots make it possible to transport the young plants to the planting ground without taking them from the soil. The seedlings are very tender and may easily be injured by exposure of their roots to the dry air. The use of boxes also serves to keep the young trees from developing taproots so long that they can not easily be transplanted. Two or three seeds should be sown in each pot, or in groups about 2 inches apart in the boxes, and covered with about one-quarter inch of sand. The boxes should be kept moist until the seeds germinate, which they usually do in about ten days. After that time they may be set outdoors and the plants left to be watered by the rains, or they can be housed and watered artificially. In either case the plants should be watched, lest they become too wet and suffer by the fungous disease called "damping off." Where the seedlings come up thickly, it is a good plan to take from each pot or group all but the one strongest plant, and to transfer the rest to other boxes. This should be done when the plants are about 2 inches high.

#### PLANTING.

Toward the end of the rainy season, or about the first of March, the seedlings will be about 6 inches high, and may then be taken to the permanent site and planted out. If grown in pots, the whole thing may be set in the ground, and the paper or bamboo left to rot. If boxes are used, each plant should be removed from the soil and set at once in ground previously prepared with plow and harrow. If the ground is dry, it will be necessary to water each young tree as soon as it is set out, and perhaps to continue watering for a year or two, but the trees should gradually be accustomed to do without irrigation. The planting of eucalypts for commercial purposes is not advised where the trees can not find their own water within two years.

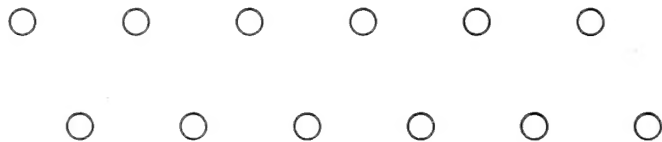
For woodlots a good spacing is 8 feet by 8 feet. This gives room to cultivate the young trees, yet sets them close enough to grow tall and clear. The plantation should be cultivated frequently for two years; at the end of that time it should be able to take care of itself.

This method of propagation is recommended because it takes advantage of the rainy season to grow the seedlings and get them established before the air becomes very dry. Some growers do not plant the seeds until spring, and a few sow the seeds in the permanent site or collect wild seedlings from an old grove. Any of these methods may be followed, though the first described is apt to be the surest and best. Those who contemplate planting will naturally compare the cost of seedlings from a nursery with the cost of those they may raise.

## WINDBREAKS.

It is decidedly unfortunate that blue gum can not be planted more widely for windbreaks. If set out with an orchard, the windbreak will easily keep ahead of the fruit trees. In most cases it will attain a height of 50 feet or more in six years, and of 100 feet in ten years. The great value of blue gum for windbreaks lies in the facts that it grows very tall without taking up much ground, that it is firm against all winds but tornadoes, and that its crown is flexible and elastic, and, by bending, diverts the wind diagonally upward, instead of offering a resistance that forces it to go through in strong currents. On the other hand, there is the disadvantage that the clear trunks offer little opposition to the wind near the ground. This, however, is easily overcome by planting a close row of cedar or cypress next to the gum.

Blue gum windbreaks are most effective when composed of two rows of trees set 4 feet apart in the following manner:



Many planters, however, are satisfied with a single row.

The intervals between parallel windbreaks will vary according to the character of the local winds, but in most parts of California it is thought best to have them not more than 400 feet apart. The trees may be obtained, planted, and cared for in the same way as those in woodlots.

Either Monterey cypress or Italian cypress is recommended for the lower part of a composite windbreak. Both grow quite rapidly and will maintain a dense hedge to a height of from 30 to 40 feet. One row of blue gum and one row of cypress are all that is necessary. The latter may take the place of the leeward row of blue gums indicated in the diagram above, though when the cypress trees are about 10 feet high every other one should be removed, leaving them 8 feet apart. The blue gums should be maintained with their original spacing of 4 feet by planting a new tree wherever one dies.

## FIRE.

Every eucalyptus plantation must be carefully guarded from fire. The fallen leaves, twigs, and bark shreds, which always cover the ground to considerable depth, are naturally oily, and in the dry air of the Southwest become highly inflammable. If a fire once starts it is almost impossible to put it out before the heat, if not the direct flame, has killed or seriously injured the trees. The bark of the trees is not thick, and affords little protection to the living tissue.



## CUTTING.

Since it is always advisable to reproduce a eucalyptus grove by means of stump sprouts, care should be taken that the trees are felled between November and April, and that the stumps are cut low, smooth, and slanting on top. When the cutting is done at the right time the sprouts are vigorous and have time to harden, while the roots are not exhausted. The stumps should be low, in order that the new shoots may be forced to start close to the ground and establish their own roots as soon as possible, and smooth and slanting, so that rain water may not gather on them and hasten decay. When the shoots reach a diameter of about 2 inches, all but three or four of the straightest, most vigorous, and best placed ones should be cut out from each cluster. This thinning should yield enough firewood to pay for the cost, but whether it does or not it should not be omitted, for it will cause the remaining shoots to grow much faster by giving them more light and room.

## COST OF AND RETURNS FROM PLANTATIONS.

Windbreaks are usually made without much reference to their cost, for they are often indispensable. Woodlots, on the other hand, should pay at least as much, either directly or indirectly, as the land they occupy would yield in any other crop.

The cost of establishing a plantation of blue gum will depend largely upon local wages. The cost of maintaining it when once established depends entirely on the rental value of the ground. The following figures may be accepted as the average cost of establishment for an acre in most localities. All expenses, with compound interest at 5 per cent, are carried to the time when the plantation is 12 years old and yields its first crop.

Preparation of soil-----	\$7. 00
700 plants, at \$8 per thousand-----	5. 60
Planting -----	4. 00
Cultivating 5 times, first year-----	2. 50
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	19. 10
Interest on \$19.10 for 12 years-----	15. 20
Cultivating 3 times, second year-----	1. 50
Interest on \$1.50 for 11 years-----	1. 06
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Total cost, excluding land rent, at end of 12 years-----	36. 86

Disregarding the small possible yield from thinnings before the main crop is mature, the wood that can be cut at the end of twelve years will probably amount to 60 cords. This will bring \$3 per cord on the stump, or a gross income of \$180.

The net income at the end of twelve years is what remains after deducting the gross cost of the plantation exclusive of rent, \$36.86,

from the gross income, \$180, or \$143.14, which is equivalent to an annual net income of \$9 with interest at 5 per cent. If the rental value of the land is \$5, the annual net profit would be \$4; if the rental value is \$6, the profit is \$3, and so on.

After the first crop, the returns will be greater, because planting and cultivation will be saved and the trees will be large enough to cut again in eight years. For the second and succeeding crops, the yield will be 60 cords of wood at \$3 per cord, or \$180, which, since there is no expense, is the net income from 1 acre for eight years, equivalent to an annual net income of \$18.85. Again assuming a land rental of \$5, there remains a net profit of \$13.85 per acre per year.

#### RED GUM (*Eucalyptus rostrata*).

This species does not grow so rapidly as blue gum, but in most other respects is superior to it. Comparatively few plantations have so far been made in the United States, but those that are established give promise of quite as good returns as any of blue gum. The tree is more hardy than the blue gum, and will withstand more alkali and more drought than the latter. When young, it is nearly as susceptible to frost as the blue gum, but mature trees may survive as low temperatures as 15° F.

The wood is heavy and hard like that of blue gum, but is red in color and much more durable. This last quality apparently makes it available for posts, poles, and piles, and goes far to recommend it in preference to blue gum. Plantations may be made in the same way as those of the commoner species, and at about the same cost. Planters are recommended to give this tree a trial, especially where there is a demand for other material than firewood.

#### SUGAR GUM (*Eucalyptus corynocalyx*).

The chief value of this species is that it endures more drought than either of the others described. In most of its qualities it is similar to red gum, and under good conditions grows nearly as rapidly.

The wood is heavy, not so hard as blue gum, easy to split, makes a very hot fire, and is moderately durable. It is also said to season better and to work more easily than the wood of other eucalypts.

The tree may be propagated in the same way as blue gum, and is recommended for planting because of its good qualities, among which is its ability to grow in localities where the heat and drought are too severe for other species.

Approved.

JAMES WILSON,

*Secretary.*

WASHINGTON, D. C., November 24, 1906.





